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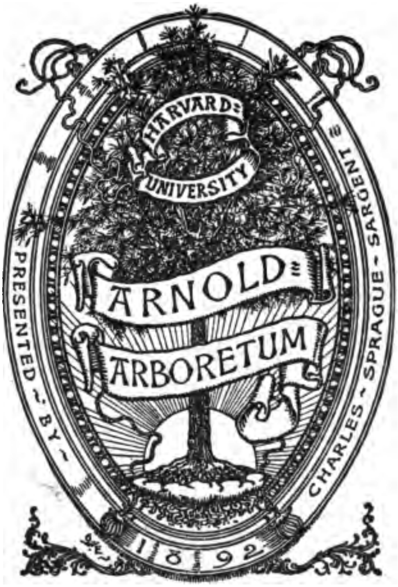

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Defects in Wood Caused by Insects.

A. D. Hopkins

JANUARY, 1894.

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BULLETIN 35.

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ENTOMOLOGICAL DEPARTMENT.

VII Injurious and Other Insects of West Virginia.

4 Forest and Shade Tree Insects.

DEFECTS IN WOOD CAUSED BY INSECTS.

By A. D. Hopkins,
Morgantown, West Virginia.

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All of the illustrations in this Bulletin except Fig. 21 are drawn from nature by the author.

DEFECTS IN WOOD CAUSED BY INSECTS.

BY A. D. HOPKINS.

I have recently had occasion to conduct some investigations with reference to the damage caused by wood-boring insects, and to study the habits of some of the species causing the kinds of defects most frequently met with. I find that there are many different kinds of defects which are caused by as many different species of insects, some of them being very destructive or injurious to the wood, while the damage caused by others is comparatively slight. Some of the insects infest only dead trees, logs and stumps; others attack injured or unhealthy, standing trees, while still others prefer to attack the healthy wood of living ones. Certain species inhabit only the sap-wood, while others enter the sound heart-wood and perforate it with numerous holes, which may extend for several feet through the best part of the wood.

It has been ascertained that the holes produced by different kinds of wood-boring insects usually have some marked characteristics peculiar to the species, or to a class of nearly related species, and that while the common term "worm holes," used to designate these peculiar injuries, may be properly applied to some of them, and "pin holes" to others, these two common names can not be properly used for all. Therefore, in order that we may refer to the different kinds of defects caused by insects, by some simple, descriptive names, I will present the following, provisional classification and popular names.

1st. Pin Holes. Small, round holes, one-hundredth of an inch to one-fourth of an inch in diameter.

2nd. Worm Holes. Large, irregular, flattened, or oblong holes, one-fourth of an inch, or less, to one and one-half inches in diameter.

3rd. Black Holes. Rows, or single, black-lined holes about one-twelfth of an inch in diameter, accompanied by discolored streaks, or patches in the wood.

4th. Sap-wood Holes. Occuring only in sap-wood, including sap-wood pin holes, sap-wood worm holes, sap-wood black holes.

5th. Enlarged Holes. Any of the above which are enlarged by ants or other insects, or by decay.

Pin Holes in Heart-Wood *

This defect is commonly met with in Oak and Chestnut, especially in the latter. When these holes occur in a tree or piece of wood, they are usually found of various sizes, and are in large numbers within a given space. When they occur in the sound timber, they are usually lined with a substance of about the same color as that of the surrounding wood, and are seldom accompanied by discolored streaks. They are produced by small, long, round-bodied worms, which are the young form of (winged) beetles. The adults of this class of wood-boring insects place their eggs in the crevices of the bark, or in the edge of wounds in the bark or wood. The minute worms hatching from the eggs bore directly into the wood, forming at first holes so small that they are scarcely visible to the unaided eye. They do not stop in the sap-wood, as some kinds do, but extend their burrows to the heart of the tree or farther, each worm making for itself a separate burrow in which it remains until matured. The borings, excrements and surplus secretions from the wood are pushed out from the original entrance by them, as they move back and forth, which they must frequently do both for the purposes mentioned, and in order that they may each time slightly enlarge the burrows to accommodate the increasing size of their bodies. Thus the holes made by these insects are found to vary in size, and to extend several feet through the wood.

Pin Holes in Chestnut Wood.

These are familiar to every one who has handled or manufactured much of this wood, and are good examples of what are termed pin holes.

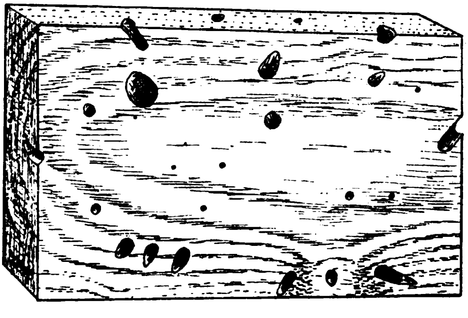

Fig. 1.—*Pin Holes in Chestnut Wood.* 1-100 to 1-4 in. in diameter.

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*The term pin holes, used to designate certain kinds of holes in wood produced by insects, no doubt originated with stave makers and coopers from the fact that such holes are often plugged with small wooden pins. Augur holes in lumber, from rafted logs are, in certain localities, sometimes called pin holes, but I believe defects of this kind are more often designated by the proper name, augur holes.

The characteristic appearance of pin holes in chestnut boards is shown in Fig. 1. The insect to blame for this defect is known as the Chestnut Timber Worm. Fig. 2. The distinctive characters which will enable any one to identify this odd-looking worm are the peculiar, hood-like enlargements just back of the head, and the dark-brown, horny gouge with its toothed edge on the opposite extremity of the body. This insect infests logs, stumps and dead trees, also living trees of all sizes, but are most common in old ones, or those which have attained considerable size.

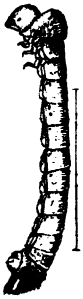

Fig 2.—*The Chestnut Timber Worm.* Body yellow; length 7 8 in., width 1-8 in.

It appears that they will not infest a living tree unless some wound in the bark or wood occurs in which the parent beetle can deposit her eggs; however, the slightest wound is sufficient to start a colony of them to work in a tree. A broken or decayed branch, or a wound in the bark of a standing tree caused by the falling of another against it, or by anything that breaks through the bark, will be sufficient to give them a start. I have found that a wound produced by a small bullet in a young, thrifty tree was sufficient to attract the parent beetle to the spot for the purpose of depositing her eggs, and that although the wound had been made ten years (ascertained by counting the annual growths), the wood at that point was still infested by the worms, thus indicating that one wound may be utilized year after year by succeeding generations of the insect. Another example observed was that of a wound in the bark and wood of a young tree six inches in diameter, caused by a load of shot, which had been the means of starting so many of the worms to work in the wood at that point, that the tree was apparently dying from the injuries.

Although it is known that the parent, or adult form of the Chestnut Timber Worm is a beetle, the exact species has not as yet been discovered. This insect is being studied, however, and I hope soon to be able to present a more complete account of the species and its destructive work, with suggestions for preventives, remedies, etc.

Pin Holes in Oak

Another example of pin holes in heart-wood is quite frequently met with in various kinds of oak, and these are familiar to most persons who have had much to do with this wood, the characteristic appearance of which is represented in Fig. 3.

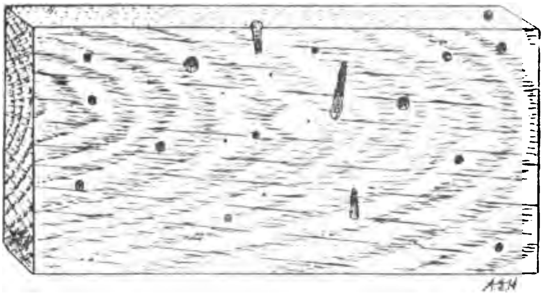

Fig. 3.—*Pin Holes in Oak Heart-Wood.* 1-100 or less to 1-8 in. in diameter.

These holes are serious defects when they occur in staves, heading and lumber. They are also a serious detriment to square timber used in structures, the wood work of which is exposed to the weather.

The kinds of pin holes most common in oak heart-wood are caused by the Oak Timber Worm, Fig. 4, which has habits similar to those of the Chestnut Timber Worm. The young ones are long, slender, about the size of a small pin; hence are often called "Pin Worms." The distinctive characters of this timber worm are sufficiently represented in the illustration, Fig. 4.

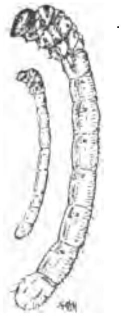

Fig 4—*The Oak Timber Worm:* natural size and enlarged; body white: head brownish.

This insect appears to prefer logs, stumps, and trees, which have been dead or felled one or more years. They will, however, occasionally infest the perfectly sound wood of living trees, and occur quite frequently in the unsound wood of the same; but from my observation, it apppears that they will not attack living trees unless there has been some previous and quite severe injury to the bark and outer sap-wood.

The adult, or parent of the oak timber worm, is an odd-looking snout-beetle, as will be seen by reference to Figs. 5 and 6. It will be observed that the female (Fig. 5.) has a longer snout or proboscis than the male (Fig. 6.), with which she is provided, that she may puncture the bark or wood for the purpose of forming receptacles for her eggs.

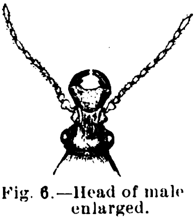

Fig. 6.—Head of male enlarged.

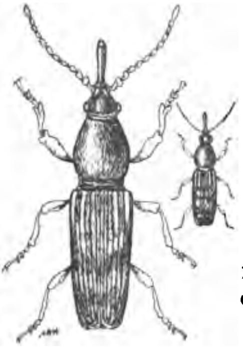

Fig. 5.—*Adult of Oak Timber Worm.* Female enlarged and natural size; reddish brown with yellowish markings.

Pin Holes in Sap-Wood.

There are numerous kinds of pin-holes which occur only in sap-wood. These are caused principally by a class of insects known as timber beetles, which includes a large number of species. Figs. 8, 10, 12 and 14 are good representatives of this class of insects, They are thus named on account of the habits of the adults, which bore into the wood for the purpose of excavating galleries in which their eggs may be deposited. The galleries excavated by these beetles are of two characteristic forms. Figs. 7 and 9 represent one form, the characteristic features of which are the short side or brood chambers extending from the main gallery. The parent beetles excavate the main galleries, and deposit their eggs in small cavities at more or less regular intervals along the sides. The young, as soon as hatched, proceed to enlarge and extend these cavities at right angles to the main gallery, and usually with the grain of wood, but only in proportion to the length and breadth of their bodies as they increase in size. The entrance to each of these brood chambers is kept securely sealed from the time the young are hatched until they are ready to emerge as fully matured beetles. When each adult is fully matured, it breaks through its prison door, and comes out into the main gallery through which it passes to the open air. Thus the entire brood emerges from the original entrance to the galleries in which they developed.

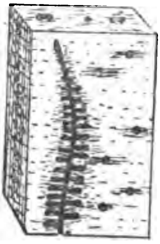

Fig. 7.

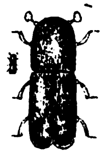

Fig. 8.

Fig. 7.—*Pin Holes in Sap-wood*: Natural size; showing galleries and brood chambers of Fig. 8.

Fig. 8.—*The Apple Timber Beetle*: Natural size and enlarged; dark brown, shining.

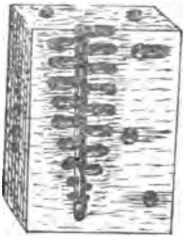

Fig. 9.

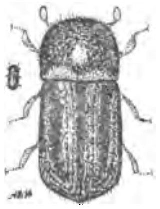

Fig. 10.

Fig. 9.—*Pin Holes in Sap wood:* Natural size: galleries and brood chambers of Fig. 10.

Fig. 10—*The Spruce Timber Beetle:* Natural size and enlarged; some examples have black and light brown stripes on wing covers, others are plain brown.

Figs. 11 and 13 illustrate the other characteristic form of galleries adopted by quite a number of species. These are also excavated by the parent beetles, but instead of depositing their eggs in cavities in the sides of the galleries, they place them in unprotected groups within the walls. The

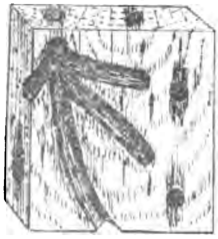

Fig. 11.—*Black Pin Holes in Sap Wood.* Natural size; showing galleries of Fig. 12.

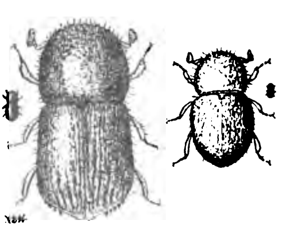

Fig. 12.—*Stout Timber Beetle.* Male and female: natural size and enlarged: female much larger, jet black with small spines on hind edge of wing covers. Male small, light brown, without spines.

young are small, white grubs, which do not enlarge and extend the galleries, but appear to feed on a substance coming from the wood. All stages, from eggs to fully matured adults, often occur together in one main gallery. It appears that the young beetles do not necessarily emerge from the galleries in which they develop, in order to excavate new ones, but may extend secondary and branching galleries in which to deposit eggs for another brood. One marked peculiarity of most of the species inhabiting galleries of this character is the extreme small size of the male as compared with that of the female. (Figs. 12 and 14.) It appears that these small males, which are not capable of flying, never emerge from the galleries in which they develop.

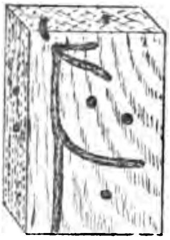

Fig. 13.—*Pin Holes in Sap-wood.* Natural size; showing galleries of Fig. 14.

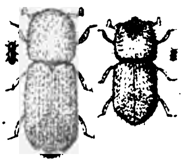

Fig. 14.—*The Hairy Timber Beetle.* Male and female; natural size and enlarged, female larger, light brown, covered with hairs, a few small tubercles on hinder part of wing covers. Male smaller, light brown, with depression and a small spine in front.

The holes produced in wood by each species of timber beetles are always more or less uniform in size from the fact that, as the adults do the excavating, their burrows are only just large enough to allow them to pass freely back and forth.

Nearly all of the valuable kinds of wood are infested by one or more species of these timber beetles, but as a rule they enter only the wood of diseased, dying or felled trees. Most of them prefer to enter the wood immediately after the sap ceases to flow, or before the sap-wood is entirely dead.

Stumps, saw logs and trees, cut during the winter and early spring and allowed to remain with the bark on through the spring and summer months, offer the best conditions for the development and increase of this class of insects, and the sap-wood of certain kinds of timber thus neglected is usually thickly perforated with their galleries.

Sap-Wood Timber Worm.

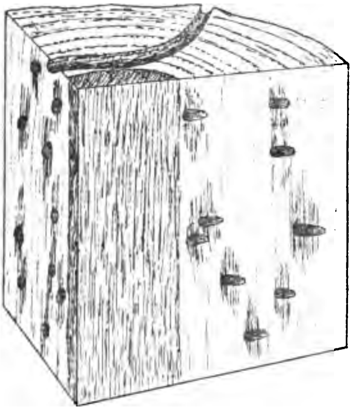

Fig. 16.—*Pin Holes in Sap-wood* by Fig 17, showing how the sap-wood is penetrated, and the heart-wood is avoided.

Fig. 16 represents another characteristic form of sap-wood pin holes frequently met with in saw logs and dying trees of different kinds. This is the work of an odd-looking worm, the distinctive characters of which are sufficiently illustrated in Fig. 17, to enable any one to readily recognize it. I have reared the adults of this insect, and find that the worms remain in the burrows through the winter, and that the adult (Fig. 18) emerges in April and soon after the females deposit their eggs for another brood. It appears from my observation, that the beetle will not deposit her eggs on, or in logs from which the bark has been removed, but chooses for this purpose only those with the bark on. Felled trees and saw logs cut during the fall, winter and early spring months and allowed to lie with the bark on through April, May, June and July, offer the most favorable conditions for the propagation and destructive work of this insect. The eggs are deposited in the crevices of the bark, often fifteen to twenty in a single crevice. As soon as hatched, the young worms bore directly through the bark and into the sap-wood, where they proceed to the right or left and extend their burrows a foot or more across the grain of the wood. Some of them occupy the outer portion of the wood, just beneath the bark, while others extend parallel burrows at different depths between the surface and the outer heart-wood, as shown on title page and in Fig. 16. The habits of this worm in extending and enlarging the burrows are similar to those of the chestnut and oak timber worms mentioned on another page.

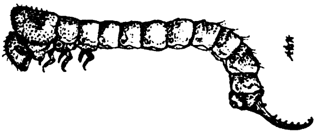

Fig. 17.—*Sap-Wood Timber Worm*, Larva of Fig. 18, enlarged; body yellow, length 3-4 in., width 1-8 in. Head and spiny tail brown.

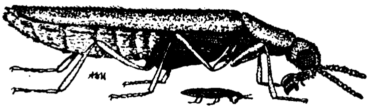

Fig 18.—*Adult of Fig. 17.* Natural size and enlarged; head, thorax, and wing-covers, black and covered with fine hairs, abdomen and legs yellow; two prominent, feathery projections from mouth. Female with yellowish head, thorax, abdomen and legs; wing-covers black; without feathery projections from mouth

I have observed the kind of pin holes produced by this worm in yellow poplar, bass-wood, buckeye, chestnut, and black walnut, and have found this insect to be very destructive to the sap-wood of yellow poplar saw logs which are allowed to lie with the bark on. They often cause a total loss of from five to ten per cent.

of a log which would otherwise make first and second grade lumber. In other words, every 1,000 feet of sap-wood so affected represents a loss of from $15 to $20.

To Prevent Insect Injuries to Sap-Wood.

It has been found that nearly all of the insects which cause defects in sap-wood of logs and dying trees, attack only those with the bark on; therefore, in order to prevent these defects, it is only necessary to remove the bark before the insects deposit their eggs or enter the wood. *Take the bark from all logs and felled trees cut between October 1st and April 1st, that will have to lie more than one month after the latter date before they can be converted into lumber, and from all logs cut between April 1st and October 1st, unless they can be converted into lumber directly after the trees are felled* By adhering to this rule, producers in this State alone will prevent depreciation in value of lumber to the amount of many thousand dollars. As a rule, the additional expense of handling logs with the bark on, over that of handling them with the bark off, will more than pay for removing it; therefore all of the timber thus protected from depreciation in value is usually so much clear gain.

Worm Holes in Heart-Wood

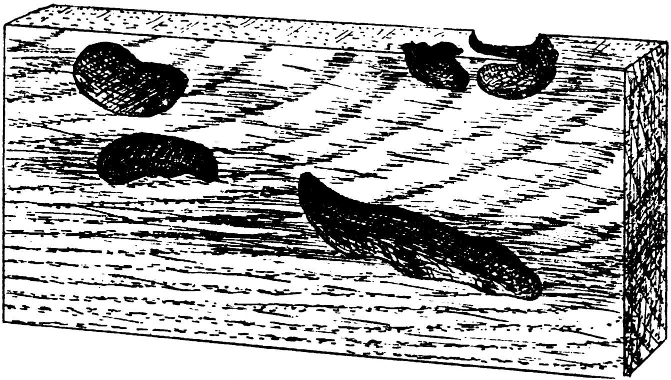

Fig. 19 — *Worm Holes in Heart-Wood*, (Red Oak): ¾ in. in diameter one way by 1 to 1½ inches the other; with dark lining and slight staining of the wood.

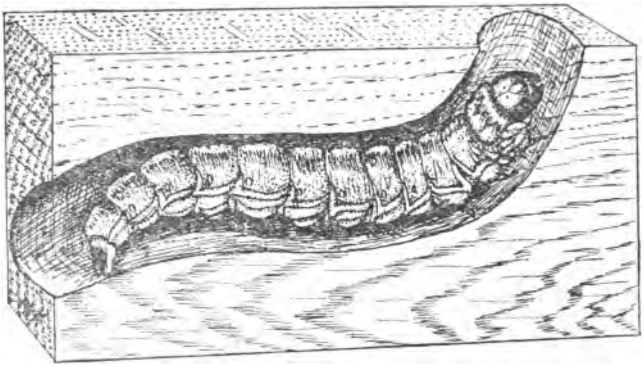

Fig. 20.—*The Carpenter Worm:* reduced; length 3 inches; width ⅝ inch; pink and white above; greenish beneath, and head shining black.

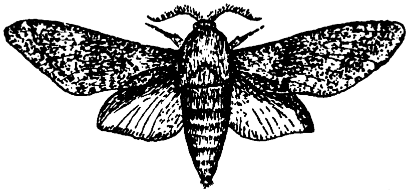

Fig. 21 *—*The Goat Moth*: adult of Fig. 20; male, natural size; front wings grey; hind wings black and yellow.

Worm holes are produced by large, wood-boring grubs, or caterpillars, (often called worms) which are the young forms of either beetles or moth. The large, irregular holes frequently met with in red oak, Fig 19, are good examples of the larger kinds of worm holes, which are frequently met with in oak and yellow locust timber. These are caused as a rule by large, wood-boring caterpillars called carpenter worms, Fig. 20, which are the young forms of "Millers" or moth like, Fig. 21.

Another class of worm holes occurring in the sap and heart-wood of different kinds of timber is caused principally by wood-boring grubs, which are often called "Sawyers." These grubs are the young of long horned beetles like that represented in Fig. 24. Common examples of holes produced by grubs of this class are met with in white pine logs and dead trees, and are caused by the "Pine Sawyer," Fig. 23, which is a good representative of this class of wood-boring grubs. This class of holes occasionally occur in heart-wood of both dead and living trees of

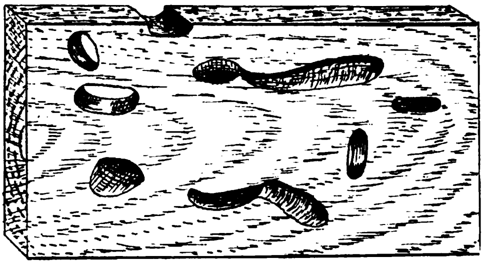

Fig. 22.—*Worm Holes in Heart and Sap-wood*: caused by wood-boring grubs like Fig. 23.

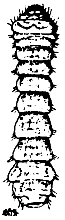

Fig. 23.—*The Sawyer*: larva of Fig. 24; yellowish white with brown head.

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*Stippled drawing from wood-cut by Riley.

various kinds, and are very serious detriments. They not only depreciate the value of the timber, but often render worthless that portion which would otherwise be the most valuable; especially is this so with the kind frequently met with in the heart-wood of living, yellow poplar trees, which have been injured by fire or some other cause.

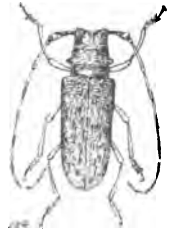
Fig. 24.—"*Grey Beard,*" or *Longicorn Beetle*: adult of Fig. 23: natural size; grey, with dark and light spots on wing covers

Fortunately, there are only a comparatively few species which cause worm holes in heart-wood, or at least penetrate such wood to any great distance below the sap-wood. Like the timber beetle, most of the kinds causing these defects prefer to inhabit only the sap-wood, and when such is the case, they cause what may be termed worm holes in sap-wood. Of the hundreds of species that inhabit the sap-wood, very few indeed prefer to attack that of living trees. Like the timber beetle, they nearly all infest the wood of diseased or dying trees, logs and stumps, especially trees which die in the spring, and logs which are cut in the winter and spring and allowed to lie with the bark on.

Black Holes in Wood

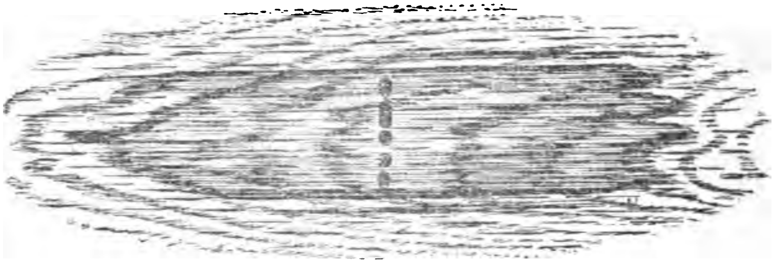
Fig. 25.—*Black Holes and Columbian Stain in White Oak:* natural size.

Black Holes in Wood is a name applied to certain characteristic black holes, which are common both in sap and heart-wood of living trees. This common defect will be the subject of our next Bulletin, (No. 36.)

Enlarged Holes in Wood.

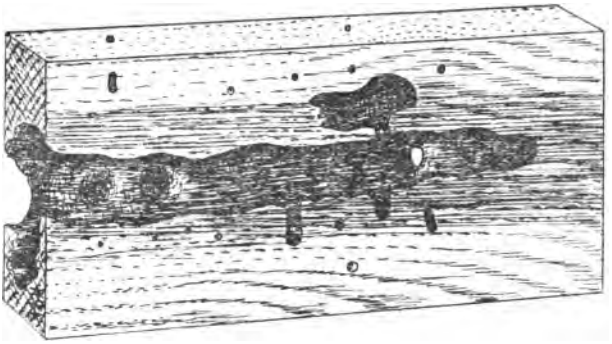

Fig. 26.—*Enlarged Holes in Wood.*

Enlarged pin holes or worm holes often occur in living and dead trees, logs, etc. In most cases, this enlargement or extension of the injuries is caused by different species of wood-infesting ants, and may be caused by them either before or after decay sets in. The characteristic appearance of these enlarged holes is represented in the above figure, where pin holes caused in red oak, evidently by the oak timber worm, have been enlarged by black ants.

Character of Loss Resulting from Insect Injuries in Wood.

The damage and loss resulting from the presence of different kinds of insect injuries in wood, may be classed under two heads as follows:

1st. Depreciation in value of otherwise sound and clear lumber and timber, causing losses to owners of timber and manufacturers of timber products.

2nd. Premature decay, resulting from the presence of the holes, which allow moisture and fungus germs to obtain lodgment in the sap and heart-wood of trees, logs and manufactured timber products, thus causing serious loss to both producers and consumers.

Amount of Losses Resulting from Insect Injuries in Wood.

The losses from depreciation in value of timber and lumber on account of insect injuries, while known to be very great, would be difficult to represent in dollars and cents, without further knowledge regarding the extent and distribution of the different kinds of defects, and the per cent. of manufactured material affected by each.

I have endeavored to obtain further information on this subject, by means of circular letters, mailed to lumber manufacturers in different sections of the country. While I have received some very satisfactory answers, containing valuable information, the replies have as yet been far too few, upon which to base satisfactory estimates. It would appear, however, from my own observation, and from such information as has been obtained by inquiry, that the proportion of manufactured timber products depreciated in value on account of insect injuries alone, may vary with different kinds of timber, and in different localities, anywhere from 2½ to 50% of the total output, and that in some cases the depreciated value is sufficient to reduce the cash receipts of an investment below the cost of production.

When it is considered that a large per cent. of this loss can be prevented at comparatively small cost, it will be realized that the subject is well worthy of attention, and that those who suffer the loss can well afford to give some time to the answering of questions which would lead to a better knowledge of certain obscure points; especially, as they would get in return valuable information, by means of which they could add very considerably to the profits of their business.

Distribution of the Troubles.

The fact that the different species of insects which cause defects in wood have been taken or reported by entomologists, from many different sections in North America, is evidence that most of the kinds of defects mentioned in this bulletin occur in forests throughout the United States.

Methods of Combating Wood Infesting Insects.

Methods of combating wood-infesting insects and preventing loss from their injuries may be classed under three heads as follows:

1st. *Remedies*. Including methods of destroying the insects, and of checking their ravages.

2nd. *Preventives*. Including methods of repelling the insects or preventing their attack.

3rd. *Precautions*. Including methods of management of standing, felled, and manufactured timber, to prevent the increase of insect pests, and losses from their depredation.

To the above, we may add the following:—

Expedients. Including methods of utilizing to the best advantage, timber and lumber affected by defects which have already occurred, or can not be prevented.

In the application of the first method, there is little that can be accomplished, from the fact that, after wood-infesting insects once make the attack, and have entered the wood, they are securely protected from all attempts to destroy them, except perhaps that of burning or steaming the infested wood, which is not always practicable. The introduction of natural enemies to destroy them may be considered under this head, but this method can only be applied under certain, peculiar conditions, and is not to be thought of until both the enemy and the friendly insects have been thoroughly studied.

It is upon the second methods we must rely for the successful treatment of wood-infesting insects. The old adage, "An ounce of preventive is worth a pound of cure," is even more applicable in this case than in the treatment of diseases. With a knowledge of the habits of an insect, we can usually find some simple means of preventing their attack. For example, if a given insect makes its appearance in May and June, and deposits its eggs only during these months, and only in logs with the bark on, all injuries from its attack may be easily prevented by simply not allowing logs to lie with the bark on during the months mentioned. Many thousand dollars worth of timber can be annually saved by such methods if intelligently applied.

In regard to precautionary methods, we may mention the destruction by fire of useless material, which would favor the breeding and increase of destructive species. The proper time of year in which to fell timber is also a very important question to consider, since it is a well known fact, that trees felled in certain months, will lie for years without being infested by insects, while the same kind of tree, felled during other months, will be "literally eaten up" in a single season.* This is from the fact that trees cut just before certain insects make their appearance to deposit eggs, will offer the most favorable conditions for attack, while trees felled just after the egg-depositing period is passed, will be free from their attack during that year, and by the next the conditions of the wood and bark will be objectionable to them.

One of the most important precautions to be considered by owners and producers, is that of reporting to the Entomologist the appearance of a new pest, or a new injury of a threatening character as soon after it is observed as possible, since immense loss can often be prevented by the prompt application of the proper remedy. The invasion of a new insect pest is often to be compared to that of a conflagration, which at first may be easily extinguished, but if neglected, only for a short time, can not be controlled by the best equipped fire company.

In regard to methods of making the best possible use of defective timber and lumber, we may say that they are by no means the least important, since much loss on account of depreciation in value can be prevented, by manufacturing affected timber into dimensions suitable for uses where the defects would be the least detrimental; also into material, the value of which would be depreciated least on account of the defects. The use of defective material in manufactured articles and wooden structures, where it would be the least objectionable or detrimental, and the treatment of defects with substances to prevent decay, are also to be considered.

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*This remarkable difference is attributed by many persons to the effect of the moon, and so positive are some lumbermen that this is a fact, that it is useless to argue with them to the contrary.

After all, little can be accomplished toward effective measures, by those who suffer the loss, unless they take sufficient interest in the subject of scientific research to inform themselves on some general facts relating to insect life, which is necessary in order to adopt and intelligently apply the proper and most effective methods.

It is a well-known fact that for a physician to successfully treat a disease, he must first study the symptoms and peculiar character of the complaint, and determine what the disease is; after which, if it is one that can be cured, he knows, or is supposed to know just what kind of medicine to administer. It is much the same with regard to methods of combating insect foes. We must first determine the species of insect to blame for a given trouble, then, if it is one whose life history is well known, as for instance where and when the eggs are deposited, the habits of the young, how long it takes them to develop, when the adult form emerges from the wood, how many broods there are in a season, how and where the insect passes the winter, etc., we then know the weakest point and can tell just what method will prove most effective. On the other hand, if it is an insect of which very little is known, we must study its habits, in order to determine the best method of destroying or repelling it.

Persons who have not given the subject special attention have little idea what a difficult and complicated matter it is to study and become familiar with the life history and habits of an insect, even of the commonest kind, so many and varied are the forms and habits of a single species during its life from the egg to the adult. Of all the insect pests, which the entomologist finds it necessary to investigate, there are none perhaps so difficult to study as those which inhabit the bark and wood of trees, hidden as they are during the greater part of their lives beneath the surface. Hence, comparatively few species possessing this habit have been thoroughly studied, and there remain, no doubt, many hundreds of species yet to be discovered. It is encouraging, however, to know that of those which have been studied and their habits determined, some simple means have been found to lessen the damage and loss caused by them, and in many cases to entirely prevent their destructive work, with but little expense.

It is not to be supposed that every one is to undertake the difficult task of studying the life history of insects destructive to their property. At the same time it is of the greatest importance that every one who suffers loss from insect pests, should obtain some general information regarding the different kinds, and should observe their habits, as far as possible.* Very often the observations of those who have only a slight knowledge of the subject, if reported to the entomologist, may lead to important discoveries regarding the obscure habits of an insect, or to new methods of repelling and destroying it.

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*Those who may desire to know what has heretofore been published regarding the principal forest tree pests, we would refer to the Fifth Report of U. S. Entomological Commission by Dr. A. S. Packard, issued by the Dep't of Agriculture.

In the limited pages of this bulletin, it has been possible to refer only in a general way to the principal defects in wood caused by insects. We trust, however, that it contains sufficient information to give some idea of the true character of the injuries, the kinds of insects causing them, the loss resulting from their presence in timber products, and methods of combating them. We also trust that its contents will call the attention of our readers who suffer loss from insect depredation, to the importance of having further information upon the subject; that it will lead them to make more critical observations with reference to the different kinds of injuries, and the prevalence of each in their respective localities, and that it will induce them to report promptly to us any unusual occurrence of a insect or insect injury, together with specimens of the same. Thus we will be enabled to give, in addition to replies by letter, in future bulletins the fullest accounts of those insects and injuries which are of the most importance.

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